

A METHOD FOR RECOVERING 3D SCENE STRUCTURE AND CAMERA MOTION DIRECTLY FROM IMAGE INTENSITIES

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ABSTRACT OF THE INVENTION

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The present invention is directed to a method for recovering 3D scene structure and camera motion from image data obtained from a multi-image sequence, wherein a reference image of the sequence is taken by a camera at a reference perspective and one or more successive images of the sequence are taken at one or more successive different perspectives by translating and/or rotating the camera, the method comprising The steps of determining image data shifts for each successive image with respect to the reference image; the shifts being derived from the camera translation and/or rotation from the reference perspective to the successive different perspectives; constructing a shift data matrix that incorporates the image data shifts for each image; calculating a rank-1 factorizations from the shift data matrix using SVD, with one of the rank-1 factors being a vector corresponding to the 3D structure and the other rank-1 factor being a vector corresponding to the size of the camera motions; dividing the successive images into smoothing windows; recovering the direction of camera motion from the first vector corresponding to the 3D structure by solving a linear equation; and recovering the 3D structure by solving a linear equation using the recovered camera motion. In accordance with the present invention, the method includes computing a first projection matrix; recovering camera rotation vectors from the shift data matrix, and the first projection matrix; computing a second projection matrix; and recovering the direction of camera translation using the shift data matrix, the reference image, the

second projection matrix and the recovered camera rotation vectors. In addition the method includes recovering the 3D structure from the shift data matrix, the reference image, the recovered camera rotation vectors and the recovered direction of translation vectors.